REMARKS

In the office action dated March 14, 2002, the disclosure has been objected to because of missing headings of sections. The Applicant herewith files a substitute specification with the appropriate section headings. No new matter has been added. A marked-up copy and a clean copy of the substitute specification are attached hereto. It is submitted that thereby the objection to the disclosure is rendered moot.

Claim 10 has been rejected under 35 U.S.C. §112, first paragraph. Claim 10 has been amended so as to properly recite the claimed feature. Furthermore, the Examiner is please asked to notice that two kinds of suitable polymers, namely poly-tiophen and poly-arylamin, are disclosed in the second to last paragraphs of page 2. It is therefore submitted that the disclosure is enabling. It is submitted that this rejection of claim 10 is hereby rendered moot.

Claim 1 has been amended so as to more precisely recite what the Applicants regard as their invention. For the reasons set forth below, it is submitted that claim 1, as now amended, is not anticipated by the reference to Siebentritt et al.

Siebentritt et al. indeed disclose a solid state sensitized photovoltaic cell comprising, as an electron conductor, a n-type semi-conductor, as a hole conductor, a p-type semi-conductor and a layer of an inorganic absorber material there between, for forming a heterojunction (column 1 and figures 1 and 2). Siebentritt et al. further teach an absorber layer film made of CdTe with thicknesses ranging between 80 and 500 nm (see column 2, page 1823, three last lines). In column 2, page 1824 and column 1, page 1825, including table 2, Siebentritt et al. discuss the crystalline structure of said films. From X-ray diffractograms, it appears that these films incorporate crystallites with sizes

of about 20 to 40 nm. These crystallites are included within the film material and do not consist of isolated particles. Siebentritt et al. teach to improve the quality of the deposited film by an annealing procedure at 400° C (see bridging part from page 1823 to 1824). Upon annealing, the crystallites grow (see table 2), indicating that, in the film, these crystallites are embedded in amorphous portions.

Siebentritt et al. further teach to form CdS layers by a chemical bath deposition process, which is repeated between 20 and 40 times to form CdS films of a reasonable thickness. The films are annealed at 125°C (see page 1824, left column, lines 4 to 12). Under these operating conditions, the CdS material is not in the form of separated particles (see the paper to Vogel, Pohl and Weller, Chem. Phys. Let. 174, 1990, p. 243).

Thus, according to the teaching of Siebentritt et al., both the CdS and the CdTe crystallized and/or amorphous material portions are aggregated so as to form more or less continuous coating films.

To the contrary, claim 1, as now amended, no longer includes a heterojunction wherein the sensitizing semi-conductor is in the form of coating films as disclosed by Siebentritt et al. In claim 1, as now amended, said sensitizing semi-conductor is in a form consisting of particles adsorbed at the surface of the electron conductor. It is submitted, based on the whole specification and also on figure 2, that the language "a form consisting of particles adsorbed at the surface" has the meaning of separated particles.

It is further submitted that claim 1, as now amended, is not obvious over the disclosure of Siebentritt et al., either taken alone, or in view of the disclosure of Vogel et al., for the reasons set forth below.

The reference of Vogel et al. discloses a method for sensitizing TiO_2 electrodes of wet electrochemical cells by Q-dot-sized CdS particles. The Vogel et al. reference itself neither discloses nor suggests to use such CdS particles for making a solid state heterojunction.

The Examiner will please note that the reference "Vogel et al.," Chemical Physics Letters, 174, November 1990, p. 241 - 246, is identical to the paper termed as "Weller et al." and listed as bibliographic reference No. 3 in the Siebentritt et al. reference.

Siebentritt et al. not only have knowledge and cite the Vogel et al. reference among their bibliographic references, but furthermore make use of the deposition procedure of Vogel et al. However, instead of applying the Vogel et al. dipping procedure about five times, as taught by Vogel et al., Siebentritt et al. teach to repeat the Vogel et al. dipping procedure 20 to 40 times, thereby obtaining clustered aggregates of CdS material, merging to form a film. Since Siebentritt et al. indeed use the teaching of Vogel et al. concerning an elementary dipping step, but use it to obtain a completely different heterojunction and layered structure, namely a heterojunction wherein the sensitizing semi-conductor is in form of continuous films instead of separated particles, Siebentritt et al. clearly teach away from Vogel et al.

The Applicants submit that this demonstrates that it would not have been obvious to one skilled in the art, based on the teaching of Siebentritt et al., to incorporate the teaching of Vogel et al. into a solid state heterojunction as outlined by the Siebentritt et al. reference to obtain the heterojunction and the cell as claimed in the present application.

Claims 2 and 3 have been rejected under 35 U.S.C. §102 as being anticipated by

Siebentritt et al. Claims 2 and 3 have been cancelled, rendering this rejection ground moot.

Claim 4 has been rejected under 35 U.S.C. §103 as being obvious over Siebentritt et al. in view of Vogel et al. Referring to the above remarks, the Examiner is please asked to consider that claim 4 recites that the sensitizing semi-conductor particles are quantum-dot-sized particles and that Siebentritt et al. specifically teach away from this limitation, namely to form large aggregates of CdS particles by repeating the Vogel et al. dipping procedure 20 to 40 times for continuous CdTe films by electro-deposition.

Claim 5 to 8 are rejected under 35 U.S.C. §102 as being anticipated by Siebentritt et al. Claims 5 to 8 depend from amended claim 1, which, as amended, is deemed to be patentable over the prior art made of record.

Claims 9 to 12 were rejected under 35 U.S.C. §103 as being obvious over Siebentritt et al. in view of Bach et al. Bach et al. indeed teach that the organic compound OMeTAD can be a preferred hole conductor for achieving high photon-to-electron efficiencies. However, the Bach et al. disclosure applies to dye-sensitized films of TiO_2, the sensitizer being an organo-metallic Ru (II) complex. This dye is in the form of individual molecules, bound as a molecular layer by the derivatized ligands of Ru (II) to the TiO_2. Bach et al. neither teach nor suggest to replace the organo-metallic dye in the molecular state by separated particles of an inorganic material, and even less by inorganic Q-dot-sized particles. Claims 9 to 12 depend from Claim 1. Therefore, it is submitted that Claims 9 to 12 are not obvious over Siebentritt et al. in view of Bach et al. Furthermore, despite the fact that OMeTAD achieves valuable photo-to-electron conversion efficiencies in combination with molecular Ru (II) dyes, there is prima facie no reason to

expect that OMeTAD could also achieve high photon-to-electron conversion efficiencies associated to inorganic semi-conductor particles. For this additional reason, the Applicants believe that Claims 9 to 12 are not obvious over Siebentritt et al. in view of Bach et al.

Claim 13 has been rejected under 35 U.S.C. §103 as being obvious over Siebentritt et al. in view of Vogel et al. Claim 13 reads on claim 4 and therefore is deemed to be patentable too.

Claims 14 and 15 have been rejected under 35 U.S.C. §102 as being anticipated by Siebentritt et al. Claims 14 and 15 depend from amended claim 1 and therefore are deemed to be patentable too.

Claim 16 has been rejected under 35 U.S.C. §103 as being obvious over Siebentritt et al. in view of Kay et al. Claim 16 depends from amended claim 1. Kay et al. do not suggest, either taken alone, or in combination with Siebentritt et al., to sensitize a solid state heterojunction by means of separated particles. Therefore, it is submitted that Claim 16 is not obvious over the two cited references.

Claims 17 and 18 have been rejected under 35 U.S.C. §103 as being obvious over Siebentritt et al. in view of Vogel. Claim 17, as well as claim 18, which depends from claim 17, recite forming quantum-dots on the surface of the electron conductor. For the reasons set forth above, in particular in connection with claim 4, the Applicants submit that these claims are not obvious over these two references.

In view of the above, a favorable reconsideration and allowance of all pending claims is respectfully requested.

Attached hereto is page 9 that presents a marked up version of the changes made to the claims of the application by the current Amendment. Page 9 is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

Respectfully submitted,

By: _____

Clifford W. Browning
Reg. No. 32,201
Woodard, Emhardt, Naughton,
Moriarty & McNett
Bank One Center/Tower
111 Monument Circle, Suite 3700
Indianapolis, IN 46204-5137
(317) 634-3456

#169432

VERSION WITH MARKINGS TO SHOW CHANGES MADE

Please cancel claims 2 and 3 without prejudice, and amend claims 1, 4 and 10 as follows:

1. (Amended) A solid state p-n heterojunction comprising an electron conductor and a hole conductor, and [characterised in that it] further [comprises] comprising a sensitising semiconductor, said sensitizing semiconductor being located at an interface between said electron conductor and said hole conductor, characterised in that said sensitizing semiconductor is in a form consisting of particles adsorbed at the surface of said electron conductor.

4. (Amended) A heterojunction as claimed in claim [3] 1, characterised in that said sensitizing semiconductor is in form of quantum-dots.

10. (Amended) A heterojunction as claimed in claim [9] 1, characterised in that said [organic compound] hole conductor is a polymer.